UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/541,654	07/07/2005	Joachim Kupe	DP-309749	3500

7590 04/14/2011

Delphi Technologies
Legal Staff
PO Box 5052
Mail Code: 480-410-202
Troy, MI 48007-5052

EXAMINER	
NGUYEN, TU MINH	

ART UNIT	PAPER NUMBER
3748	

MAIL DATE	DELIVERY MODE
04/14/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/541,654	KUPE ET AL.	
	Examiner	Art Unit	
	TU M. NGUYEN	3748	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 February 2011*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,24,37,49-53,55-61 and 63-71* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *71* is/are allowed.

6)☒ Claim(s) *1,24,37,49-53,55-61 and 63-70* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05 July 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. An Applicant's Amendment filed on February 4, 2011 has been entered. Claims 17, 34, 54, and 62 have been canceled; claims 1, 24, 37, 49, 50, 52, 53, and 55 have been amended; and claims 63-71 have been added. Overall, claims 1, 24, 37, 49-53, 55-61, and 63-71 are pending in this application.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claim 37 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hammerle et al. (U.S. Patent 6,823,663) in view of Duvinage et al. (PTC Publication WO 02/100519) (see U.S. Patent 7,254,939) for the English equivalence).

As shown in Figure 2A, Hammerle et al. disclose a method of NOx abatement comprising:

- introducing an off-line ammonia (via Urea Injection) into an exhaust stream;

- storing the ammonia in an in-line selective catalytic reduction (SCR) catalyst (14);

- introducing engine NOx to the SCR catalyst (14); and

- reacting the engine NOx with the ammonia.

Hammerle et al., however, fail to disclose that the off-line ammonia is generated by a reformer and a reactor.

As shown in Figure 1, Duvinage et al. disclose an exhaust gas purification unit with reducing agent supply, having a SCR catalyst (4) and an off-line ammonia injection (10) at a location upstream of the SCR catalyst. As depicted in Figure 4, Duvinage et al. teach that it is conventional in the art to generate the off-line ammonia by burning (in unit (16)) fuel off-line to form burner NOx, wherein an off-line burner (16), generating an output (NOx), is upstream of and in fluid communication with a reformer (14) and a reactor (17); forming a reformate that includes primarily hydrogen and carbon monoxide in the reformer (14); and reacting the burner NOx with the reformate in the reactor (17) to form off-line ammonia. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the off-line ammonia generation taught by Duvinage et al. in the method of Hammerle et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to effectively generate off-line ammonia for use at all operating conditions of an engine.

4. Claims 1, 49, 55-57, 63, and 64 are rejected under 35 U.S.C. 103(a) as being unpatentable over Duvinage et al. in view of Kinugasa et al. (U.S. Patent 6,109,024).

Re claims 1 and 63, as shown in Figures 2 and 4, Duvinage et al. disclose a NOx abatement system, comprising:

- an in-line selective catalytic reduction (SCR) catalyst (4) having serial fluid communication with a heat engine (10, the fluid communication occurring within an in-line

exhaust flow path (2) having an exhaust flow direction from the engine towards and through the SCR catalyst;

- an off-line reactor (17) including an ammonia forming catalyst, the reactor having an output in fluid communication with the exhaust flow path intermediate the engine and the SCR catalyst;

- an off-line reformer (14) having an output carrying reformate that fluidly communicates with the reactor (17), the reformate including primarily hydrogen and carbon monoxide; and

- an off-line burner (16) having a first and a second output, the first output being in direct fluid communication with the reactor (17) and the second output being in direct fluid communication with the reformer (14).

Duvinage et al., however, fail to disclose that the SCR catalyst is adapted for storing ammonia.

As shown in Figure 2, Kinugasa et al. disclose a NOx abatement system comprising a NOx adsorber (7) disposed in-line downstream of and in fluid communication with an engine (1). Also from Figure 2, Kinugasa et al. teach that it is conventional in the art to include a selective catalytic reduction (SCR) catalyst (9) adapted for storing ammonia and being disposed in-line, directly downstream of and in direct fluid communication with the NOx adsorber (7) such that ammonia formed in a three-way catalyst (5) is stored by the SCR catalyst and is released by the SCR catalyst during a rich excursion to reduce released NOx emissions from the NOx adsorber. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the SCR catalyst taught by Kinugasa et al. in the system

of Duvinage et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to effectively remove harmful NOx emissions in an exhaust gas stream.

Re claim 49, the modified system of Duvinage et al. further includes an off-line reformer (14) adapted to produce a reformate having primarily hydrogen and carbon monoxide and disposed in selective fluid communication with, and upstream from the NOx adsorber (7) and the SCR catalyst (9), and as shown in Figure 3, an output of the reformer is in fluid communication with an in-line oxidation catalyst (6) and an in-line particulate filter (3).

Re claim 64, the modified system of Duvinage et al. further includes an off-line mixing chamber (18) disposed upstream of the reactor (17), downstream of and in fluid communication with the reformer (14), and in direct fluid communication with the burner (17).

Re claims 55-57, Duvinage et al. disclose the invention as cited above, however, fail to disclose that the system includes a plurality of NOx adsorbers being disposed in a parallel arrangement to an exhaust flow direction, the plurality of NOx adsorbers being disposed in-line, directly upstream of, and in direct fluid communication with a single SCR catalyst or with a respective plurality of SCR catalysts.

Duvinage et al. disclose the claimed invention except for applying the invention to a system having a plurality of NOx adsorbers. It would have been obvious to one having ordinary skill in the art at the time the invention was made to apply the invention of Duvinage et al. to an engine system having a plurality of NOx adsorbers in direct fluid communication with a single SCR catalyst or with a respective plurality of SCR catalysts, since the recitation of such amounts to an intended use statement. Note that both "engine with single NOx adsorber" and "engine with a plurality of NOx adsorbers" generate exhaust gases containing harmful emissions of HC, NOx,

soot, CO, etc, that require purification before the gases can be released to the atmosphere; and the mere selection of the purification system of Duvinage et al. for use in an engine system having a plurality of NOx adsorbers would be well within the level of ordinary skill in the art.

5. Claims 50-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Duvinage et al. in view of Kinugasa et al. as applied to claim 1 above, and further in view of Kupe et al. (U.S. Patent 6,832,473).

Duvinage et al. disclose the invention as cited above, however, fail to disclose that the system further comprises an oxidation catalyst and a particulate filter disposed in-line, upstream of and in fluid communication with the NOx adsorber.

As shown in Figure 2, Kupe et al. disclose a system for regenerating NOx adsorbers and particulate filters, comprising a NOx trap (32) and an off-line fuel reformer (16) to provide a reformate to the NOx trap. Kupe et al. teach that it is conventional in the art to include an oxidation catalyst (34) and a particulate filter (36) disposed in-line, upstream of and in fluid communication with the NOx trap to remove harmful soot emissions in an exhaust gas stream, wherein the particulate filter includes a gas permeable ceramic material having a honeycomb structure. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the oxidation catalyst and the particulate filter taught by Kupe et al. in the modified system of Duvinage et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to effectively remove harmful soot emissions in the exhaust gas stream.

6. Claims 52-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Duvinage et al. in view of Kinugasa et al. as applied to claim 1 above, and further in view of Stroia et al. (U.S. Patent 6,820,414).

Duvinage et al. disclose the invention as cited above, however, fail to disclose that the system further comprises an oxidation catalyst arranged on the downstream side of the SCR catalyst.

As shown in Figure 1, Stroia et al. disclose an after-treatment system having a soot filter (18) and a dual NOx adsorbers (26, 28) arranged in parallel. As indicated on lines 9-17 of column 5, Stroia et al. teach that it is conventional in the art to utilize an oxidation catalyst (40) arranged on the downstream side of the soot filter and the NOx adsorbers in order to remove unburned reducing agent that slips through the NOx adsorbers. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the oxidation catalyst taught by Stroia et al. in the modified system of Duvinage et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to prevent inadvertent release of harmful reducing agent emissions into the atmosphere.

7. **Claims 24 and 58-61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gandhi et al. (U.S. Patent 7,332,135) in view of Duvinage et al.**

Re claim 24, as shown in Figure 2, Gandhi et al. disclose a method of NOx abatement, comprising:

- storing engine NOx from an exhaust stream in a NOx adsorber (lean NOx adsorber) during a storage phase;

- forming reformate in-line including primarily hydrogen and CO at a cylinder of an internal combustion engine during a regeneration phase (rich pulses);

- reacting the reformate with the stored NOx at the NOx adsorber to produce ammonia during the regeneration phase;

- storing the ammonia in a selective catalytic reduction catalyst (NH3-SCR) during the regeneration phase, wherein the SCR catalyst being disposed in-line directly downstream of, and in direct fluid communication with the NOx adsorber.

Gandhi et al., however, fail to disclose that for a diesel engine that is typically run lean, the reformate is generated off-line by a reformer.

As shown in Figure 2, Duvinage et al. disclose an exhaust gas purification unit with reducing agent supply, having a NOx adsorber (5) and a SCR catalyst (4). As depicted in Figure 4, Duvinage et al. teach that it is conventional in the art to generate an off-line reformate (91) enriched with hydrogen and CO at a reformer (14), wherein the reformate is injected (9) into an exhaust stream for reaction at the NOx adsorber. In addition, Duvinage et al. also teach that ammonia is produced off-line by an off-line reactor (17) that converts NOx produced from an off-line burner (16) into ammonia. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the teaching by Duvinage et al. in the method of Gandhi et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to effectively generate off-line reformate and ammonia for use with a diesel engine.

Re claim 58, Gandhi et al. disclose the invention as cited above, however, fail to disclose that reacting the reformate with the stored NOx to produce greater than or equal to about 5,000 ppm ammonia during the regeneration phase.

With regard to applicants claim directed to a specified amount of ammonia during the regeneration phase, the specification of such would have been an obvious matter of design choice well within the level of ordinary skill in the art depending on design variables, such as the a required amount of NOx, type and size of SCR catalyst, operating temperature, etc. Moreover, there is nothing in the record which establishes that the specification of such presents a novel of unexpected result (See In re Kuhle, 526 F.2d 553, 188 USPQ 7 (CCPA 1975)).

Re claims 59-61, Gandhi et al. disclose the invention as cited above, however, fail to disclose that a plurality of NOx adsorbers is disposed in a parallel arrangement to an exhaust flow direction, wherein the plurality of NOx adsorbers being disposed in-line, directly upstream of, and in direct fluid communication with a single SCR catalyst or with a respective plurality of SCR catalysts.

Gandhi et al. disclose the claimed invention except for applying the invention to a system having a plurality of NOx adsorbers. It would have been obvious to one having ordinary skill in the art at the time the invention was made to apply the invention of Gandhi et al. to an engine system having a plurality of NOx adsorbers in direct fluid communication with a single SCR catalyst or with a respective plurality of SCR catalysts, since the recitation of such amounts to an intended use statement. Note that both "engine with single NOx adsorber" and "engine with a plurality of NOx adsorbers" generate exhaust gases containing harmful emissions of HC, NOx, soot, CO, etc, that require purification before the gases can be released to the atmosphere; and

the mere selection of the purification system of Gandhi et al. for use in an engine system having a plurality of NOx adsorbers would be well within the level of ordinary skill in the art.

8. Claims 65, 66, and 68-70 are rejected under 35 U.S.C. 103(a) as being unpatentable over Duvinage et al. in view of Kinugasa et al.

Re claim 65, as shown in Figure 2, Duvinage et al. disclose a NOx abatement system comprising:

- a heat engine (1) including an in-line series exhaust conduit (2);

- a selective catalytic reduction (SCR) catalyst (4) being disposed downstream from the heat engine in the exhaust conduit (2), the exhaust conduit including a fluid exhaust flow having a flow direction defined from the heat engine towards, and through the SCR catalyst; and

- a NOx adsorber (5) being disposed in the exhaust conduit upstream of, and in direct fluid communication with the SCR catalyst.

Duvinage et al., however, fail to disclose that the SCR catalyst is adapted to store ammonia; and that the system further comprises a particulate filter being disposed in the exhaust conduit upstream of, and in direct fluid communication with the NOx adsorber and an oxidation catalyst being disposed in the exhaust conduit upstream of, and in direct fluid communication with the particulate filter.

As shown in Figure 2, Kinugasa et al. disclose a NOx abatement system comprising a NOx adsorber (7) disposed in-line downstream of and in fluid communication with an engine (1). Also from Figure 2, Kinugasa et al. teach that it is conventional in the art to include a selective catalytic reduction (SCR) catalyst (9) adapted for storing ammonia and being disposed in-line, directly downstream of and in direct fluid communication with the NOx adsorber (7)

such that ammonia formed in a three-way catalyst (5) is stored by the SCR catalyst and is released by the SCR catalyst during a rich excursion to reduce released NOx emissions from the NOx adsorber. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the SCR catalyst taught by Kinugasa et al. in the system of Duvinage et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to effectively remove harmful NOx emissions in an exhaust gas stream.

As depicted in Figure 3, Duvinage et al. further disclose another embodiment of a NOx abatement system, comprising a particulate filter (3) being disposed in the exhaust conduit upstream of, and in direct fluid communication with the SCR catalyst and an oxidation catalyst (6) being disposed in the exhaust conduit upstream of, and in direct fluid communication with the particulate filter. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the particulate filter and oxidation catalyst disclosed in Figure 3 in the system of Duvinage et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to effectively remove harmful particulate matter in an exhaust gas stream.

Re claim 66, as shown in Figure 4, the modified system of Duvinage et al. further includes an off-line reformer (14) having an output (9), the output being in direct fluid communication with the exhaust conduit intermediate the heat engine and the oxidation catalyst, and the output being in direct fluid communication with the exhaust conduit intermediate the oxidation catalyst and the particulate filter, and the output being in direct fluid communication with the exhaust conduit intermediate the particulate filter and the NOx adsorber.

Re claims 68-69, as shown in Figure 4, the modified system of Duvinage et al. further includes, an off-line reactor (17) having an output (10) in direct fluid communication with the exhaust conduit intermediate the NOx catalyst and the SCR catalyst and in direct fluid communication with the exhaust conduit intermediate the particulate filter and the NOx catalyst, wherein the system further includes, a mixing chamber (18) being disposed upstream of the off-line reactor having an output in direct fluid communication with the off-line reactor, and an off-line reformer (14) having a first and a second output, the first output being in direct fluid communication with the mixing chamber and the second output being in direct fluid communication with the exhaust conduit.

9. Claim 67 is rejected under 35 U.S.C. 103(a) as being unpatentable over Duvinage et al. in view of Kinugasa et al. as applied to claim 66 above, and further in view of Stroia et al.

Duvinage et al. disclose the invention as cited above, however, fail to disclose that the system further comprises an oxidation catalyst arranged on the downstream side of the SCR catalyst.

As shown in Figure 1, Stroia et al. disclose an after-treatment system having a soot filter (18) and a dual NOx adsorbers (26, 28) arranged in parallel. As indicated on lines 9-17 of column 5, Stroia et al. teach that it is conventional in the art to utilize an oxidation catalyst (40) arranged on the downstream side of the soot filter and the NOx adsorbers in order to remove unburned reducing agent that slips through the NOx adsorbers. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the oxidation catalyst taught by Stroia et al. in the modified system of Duvinage et al., since the use

thereof would have been routinely practiced by those with ordinary skill in the art to prevent inadvertent release of harmful reducing agent emissions into the atmosphere.

Allowable Subject Matter

10. Claim 71 is allowed.

Response to Arguments

11. Applicant's arguments with respect to the references applied in the previous Office Action have been fully considered but they are moot in view of the new ground(s) of rejection.

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office Action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Communication

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Tu Nguyen whose telephone number is (571) 272-4862.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Thomas E. Denion, can be reached on (571) 272-4859. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Tu M. Nguyen/

TMN

Tu M. Nguyen

April 11, 2011

Primary Examiner

Art Unit 3748